

## REMARKS

This paper is timely filed in response to the official action dated December 24, 2008 (hereinafter “the official action”). The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith, to our Deposit Account No. 13-2855, under Order No. 30848/40704.

By the foregoing, claims 1-5 have each been amended to recite a material that comprises a random copolymer bearing at least one polyhedral oligomeric silsesquioxane group in combination with the other claim elements. Similarly, claims 7-10 have each been amended to recite a lithographic process that includes exposing a lithographic material containing a random copolymer bearing at least one polyhedral oligomeric silsesquioxane group in combination with the other claim elements. Support for the amendments can be found in the specification, for example, at page 4, lines 6-25. Claims 1-5 and 7-10 have been further amended to correct typographical errors. Claim 6 has been canceled. New claims 11-13 have been added. Support for new claim 11 can be found in the specification, for example, at page 3, lines 9-13. Support for new claims 12 and 13 can be found in the specification, for example, at page 5, Table 1. Support for new claim 13 can also be found in the specification, for example, in Example 4. No new matter is added.

The specification is also amended herein to correct a typographical error. The end column of Table 1 on page 5 of the specification was partially omitted from page 5 of the specification. Support for the amendment to Table 1 to include the omitted column can be found in the specification, for example, at page 4, lines 21-25, which indicates itaconic anhydride (IA) as one of the monomers used in the examples. Additionally, support for the amendment can be found in the priority document, which includes Table 1 in its entirety. No new matter is added.

All pending claims stand rejected. Claims 1-5 have been rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Patent No. 6,565,763 (“Asakawa”). Claims 1-5, 9, and 10 have been rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 6,420,084 (“Angelopoulos”) in view of U.S. Patent No. 5,484,867 (“Lichtenhan”). Claims 6-8 have been rejected under 35 U.S.C. § 103(a) as obvious over Angelopoulos in view of Lichtenhan and further in view of U.S. Patent No. 6,344,305 (“Lin”).

### **Rejections under 35 U.S.C. § 102(e)**

Independent claims 1-5 have each been amended to recite a material that contains a random copolymer bearing at least one polyhedral oligomeric silsesquioxane group in combination with the other claim elements.

Asakawa fails to disclose or suggest a material that includes a random copolymer bearing at least one polyhedral oligomeric silsesquioxane (POSS) group. Rather Asakawa expressly discloses that the polymer is a block copolymer or a graft copolymer, neither of which is a random copolymer. *See* Asakawa at col. 6, lines 11-16. Asakawa expressly discloses that “the block copolymer and graft copolymer, ***unlike a random copolymer***, can form a structure, i.e., a structure having micro polymer phases, in which an A phase consisting of aggregated A polymer chains are spatially separated from a B phase consisting of aggregated B polymer chains.” Asakawa, col. 7, lines 51-55 (emphasis added). Accordingly, Asakawa fails to disclose each and every element of the claimed invention. Thus, Asakawa cannot anticipate claims 1-5.

Moreover, one of ordinary skill in the art would not be motivated to modify the block or graft copolymers of Asakawa to a random copolymer because such modification would be contrary to the express teachings of Asakawa. Asakawa discloses that “the block copolymer and graft copolymer, ***unlike a random copolymer***, can form a structure, i.e., a structure having micro polymer phases.” *See id.* (emphasis added). Asakawa relies on the microphase-separation of the block or graft copolymers for formation of a pattern, which Asakawa expressly discloses can not be achieved with a random copolymer. *See id.* at col. 6, lines 11-16 (“The principle of the present invention is that a film or a bulk molded product of a block copolymer or graft copolymer is formed, which copolymer is allowed microphase-separation, and then a polymer phase is selectively removed, thereby forming a porous film or porous structure having a pattern of the order of nanometers.”). Accordingly, as a matter of law, Asakawa cannot render the claimed invention obvious.

### **Rejection under 35 U.S.C. § 103(a)**

Claims 1-5 each recite, in relevant part, a material that contains a random copolymer bearing at least one polyhedral oligomeric silsesquioxane group, wherein the alkyl substituents of the polyhedral oligomeric silsesquioxane group which are not linked to the main chain (backbone) of the polymer contain up to 3 carbon atoms. Claim 4 recites that the

alkyl substituents are ethyl groups. Claim 5 recites that the random copolymer is a (meth)acrylic random copolymer and that the alkyl substitutes are ethyl groups. Similarly, claims 7-10 each recite, in relevant part, a lithographic process that includes exposing a lithographic material containing a random copolymer bearing at least one polyhedral oligomeric silsesquioxane group, wherein the alkyl substituents of the polyhedral oligomeric silsesquioxane group which not linked to the main chain (backbone) of the polymer contain up to 3 carbon atoms. Claims 8 and 10 recite that the alkyl substituents comprise ethyl groups.

The inventors have unexpectedly discovered that a material comprising a random copolymer bearing a POSS group, with alkyl substituents, which are not linked to the main chain (backbone) of the random copolymer, containing up to 3 carbons can beneficially allow for formation of smooth, high quality structures after pattern transfer, which, in turn, can allow for high resolution pattern transfer. Examples 3 and 4 of the present application illustrate these unexpected results. The material of Example 3 includes a POSS group having cyclopentyl groups (5 carbon atoms) as the alkyl substituents. The rms roughness of the material of Example 3 was 14.8 nm. *See* the specification, Example 3, p. 6, lines 24-26. By comparison, the material of Example 4 includes a POSS group having ethyl groups (2 carbon atoms) as the alkyl substituents. The rms roughness of Example 4 was reduced to less than 1 nm. *See id*; and Example 4, at p.7, lines 9-10. Such unexpected, beneficial results were not recognized in any of the cited references.

Rather, Angelopoulos simply discloses a material having a polymer bearing a cage structure, which can be a POSS group. *See* Angelopoulos, col. 5, lines 50-67. Angelopoulos is silent as to the alkyl substituents that can be included on the POSS group, much less the effect of the alkyl substituents on the pattern forming properties of the materials. Lichtenhan only generally discloses the use of POSS groups with an indication that the R substituents can include alkyl or aryl groups such as methyl, ethyl, propyl, butyl, hexyl, heptyl, octyl, and cyclohexyl groups. *See* Lichtenhan, col. 5, lines 42-67, to col. 6, lines 1-2. Lichtenhan further discloses that the R substituents can be also alkenyl groups or alkoxy groups. There is no teaching or suggestion that the use of an alkyl group having up to 3 carbon atoms would provide any benefit, much less allow for a smooth structure and high resolution pattern transfer, as discovered by the inventors. Accordingly, Lichtenhan provides no motivation to selectively choose alkyl groups having up to 3 carbons as the R substituent of the POSS structure, as recited in the claimed invention. Lin adds nothing of relevance.

Thus, Angelopoulos, Lichtenhan, Lin and combinations thereof fail to disclose or suggest the claimed invention. Claims 1-10 are, therefore, allowable over the cited references and combinations thereof.

New, dependent claims 11-13 are allowable for at least the foregoing reasons.

**CONCLUSION**

It is submitted that the application is in condition for allowance. Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, he is respectfully invited to contact the undersigned attorney at the indicated telephone number.

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Respectfully submitted,

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